

Ice Age

Between about 10,000 and 1.6 million years ago, during the Pleistocene Epoch (or Ice Age), the Earth's climate underwent periods of alternate cooling and warming. During the periods of cooling, with an average annual temperature probably between 5 and 10 degrees Fahrenheit cooler than present, vast continental ice sheets grew in size and extended far beyond the polar regions. In addition, alpine glaciers developed locally in the higher mountains. In southern Canada, the ice sheets periodically thickened and advanced southward, some reaching the northern parts of the United States before retreating and melting back to the north as the climate again became warmer. Evidence indicates that at least four, and perhaps six or more, major glaciations affected the Spokane-Coeur d'Alene area. The last of these occurred between 10,000 and 22,000 years ago and had the most significant effect on the present landscape. The map on the back cover provides a representation of the Pacific Northwest during this most recent part of the Ice Age.

The Cordilleran Ice Sheet was that part of the southward-moving continental ice mass that covered much of the Rocky Mountains in Canada and eventually extended into the northern part of the United States. In western Washington State, it covered parts of the northern Cascade Range and the northern margins of the Olympic Mountains. A thick ice lobe (a separate tongue of the glacier mass) extended down the Puget lowland. In eastern Washington, ice lobes extended down the principal valleys and onto the margins of the Columbia Plateau. During the last Ice Age, the advancing glaciers stopped short of the Spokane-Coeur d'Alene area. Meltwater streams draining these lobes carried large quantities of sand, gravel, silt, and clay and deposited them in and along the lower valleys. The deeply entrenched Spokane Valley was partially filled with these glacial materials.

Eventually, the Purcell ice lobe moved into the valley of the north-flowing Clark Fork River near Sandpoint, Idaho and formed a massive ice dam across the valley. At the maximum glacial advance,

the dam was between 2,150 and 2,500 feet high, about four times the height of Grand Coulee Dam. As a result, melt water from other ice lobes far up the Clark Fork River drainage became ponded behind the ice dam and eventually formed a vast lake, Glacial Lake Missoula, which occupied the intricate system of valleys in western Montana.

At its highest level, the lake covered an area of about 2,900 square miles and contained an estimated 500 cubic miles of water, one-half of the volume of present-day Lake Michigan. Traces of the ancient shorelines of Glacial Lake Missoula in western Montana indicate that, at its maximum elevation, the lake was about 950 feet deep at present-day Missoula and more than 1,100 feet deep at the south end of Flathead Lake. The lake's wave-cut shorelines are faint, however, suggesting that the lake kept changing.

At the same time, other lakes were formed by the melt water from local mountain glaciers and snow fields elsewhere in the valleys and basins of the Northwest interior. The back cover depicts the Pacific Northwest during the last Ice Age. The location and likely extent of Glacial Lake Missoula and Glacial Lake Columbia are shown on this map.

Ultimately, as the water deepened behind the ice dam, the glacial lobe floated off its foundation, allowing the water in Glacial Lake Missoula to escape in an enormous "outburst" flood. The flood wave swept down the Rathdrum Prairie, through the Spokane Valley and eventually flowed across the Columbia plateau through a braided series of channels as shown on the image on this page. This flood initially eroded, then deposited sediments in the Rathdrum Prairie and Spokane Valley. The flood also created the coulees and pothole topography called the "Channeled Scablands" in eastern Washington. In 1923 J. Harlan Bretz was the first scientist to recognize the flood origin of the Channeled Scablands. He called them the Spokane Floods because he was unaware of the origin of flood. Joseph T. Pardee discovered the origins of the floods and published the evidence in 1942.

Glacial Lake Missoula Facts

The ice dam that created the lake was between 2,150 and 2,500 feet high.

At its greatest extent, the lake covered more than 2,900 square miles, an area greater than the state of Delaware.

The lake contained about 500 cubic miles of water, about one half the volume of present Lake Michigan.

At its full extent, the lake was 950 feet deep at present day Missoula, Montana.

After most flood events, the ice dam was reformed allowing Glacial Lake Missoula to refill.

